ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM

PERMIT FACT SHEET – FINAL

Permit Number: AK0053643

Donlin Gold Project

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Wastewater Discharge Authorization Program

555 Cordova Street

Anchorage, AK 99501

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Issuance of an Alaska Pollutant Discharge Elimination System (APDES) permit to:

DONLIN GOLD LLC

For wastewater discharges from:

Donlin Gold Project
4720 Business Park Boulevard, Suite G-25
Anchorage, Alaska 99503

The Alaska Department of Environmental Conservation (the Department or DEC) proposes to issue an APDES individual permit (permit) to Donlin Gold LLC. The permit authorizes and sets conditions on the discharge of pollutants from this facility to waters of the United States. In order to ensure protection of water quality and human health, the permit places limits on the types and amounts of pollutants that can be discharged from the facility and outlines best management practices to which the facility must adhere.

This fact sheet explains the nature of potential discharges from the Donlin Gold Project and the development of the permit including:

- information on public comment, public hearing, and appeal procedures
- a listing of proposed effluent limitations and other conditions
- technical material supporting the conditions in the permit
- monitoring requirements in the permit

Appeals Process

The Department has both an informal review process and a formal administrative appeal process for final APDES permit decisions. An informal review request must be delivered within 15 days after receiving the Department's decision to the Director of the Division of Water at the following address:

Director, Division of Water
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, AK 99501

Interested persons can review 18 AAC 15.185 for the procedures and substantive requirements regarding a request for an informal Department review.

See http://www.dec.state.ak.us/commish/InformalReviews.htm for information regarding informal reviews of Department decisions.

An adjudicatory hearing request must be delivered to the Commissioner of the Department within 30 days of the permit decision or a decision issued under the informal review process. An adjudicatory hearing will be conducted by an administrative law judge in the Office of Administrative Hearings within the Department of Administration. A written request for an adjudicatory hearing shall be delivered to the Commissioner at the following address:

Commissioner
Alaska Department of Environmental Conservation
410 Willoughby Avenue, Suite 303
Juneau AK, 99801

Interested persons can review 18 AAC 15.200 for the procedures and substantive requirements regarding a request for an adjudicatory hearing. See http://www.dec.state.ak.us/commish/ReviewGuidance.htm for information regarding appeals of Department decisions.

Documents are Available

The permit, fact sheet, application, and related documents can be obtained by visiting or contacting DEC between 8:00 a.m. and 4:30 p.m. Monday through Friday at the addresses below. The permit, fact sheet, application, and other information are located on the Department's Wastewater Discharge Authorization Program website: http://www.dec.state.ak.us/water/wwdp/index.htm .

Alaska Department of Environmental Conservation Division of Water Wastewater Discharge Authorization Program 555 Cordova Street Anchorage, AK 99501 (907) 269-6285	Alaska Department of Environmental Conservation Division of Water Wastewater Discharge Authorization Program 410 Willoughby Avenue, Suite 310 Juneau, AK 99801 (907) 465-5180
Alaska Department of Environmental Conservation Division of Water Wastewater Discharge Authorization Program 610 University Avenue Fairbanks, AK 99709 (907) 451-2136	

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1.0 APPLICANT

This fact sheet provides information on the draft Alaska Pollutant Discharge Elimination System (APDES) permit for the following entity:

Name of Facility:	Donlin Gold Project
APDES Permit Number:	AK0055867
Facility Location:	Approximately 10 miles North of the Village of Crooked Creek
Mailing Address:	4720 Business Park Boulevard, Suite G-25 Anchorage, Alaska 99503
Facility Contact:	Mr. Dan Graham

Figure 1 shows the location of the facility and the discharge location.

2.0 FACILITY INFORMATION

2.1 Background

Donlin Gold LLC (Donlin Gold) is proposing the development of an open pit, hard rock gold mine in southwestern Alaska, about 277 miles west of Anchorage, 145 miles northeast of Bethel, and 10 miles north of the village of Crooked Creek. The proposed Donlin Gold Project would be located in an area of low-lying, well rounded ridges on the western portion of the Kuskokwim Mountains, with elevations ranging from 500 to 2,100 feet.

The proposed Donlin Gold Project would require approximately three to four years to construct, with the mine life currently projected to be approximately 27 years. Since the proposed permit will apply during facility construction and operation, the expected changes to the water balance of the proposed facility through construction (Figure 2) and to operation (Figure 3) were evaluated in the development of the proposed permit. The mine is proposed to be a year-round, conventional "truck and shovel" operation using both bulk and selective mining methods. The proposed operation would have a projected average mining rate of 383,000 metric tons per day (tpd) and an average process production rate of 53,500 tpd. Processing components would include a gyratory crusher, semi-autogenous grinding (SAG) and ball mills, followed by flotation, pressure oxidation, and carbon-in-leach (CIL) circuits. Conventional carbon stripping and electrolytic gold recovery would produce an end product of gold doré bars, which would be shipped to a custom refinery for further processing. State of the art mercury abatement controls would be installed at each of the major thermal sources, including the autoclave, carbon kiln, gold furnaces, and retort.

The gold resource is hosted in intrusive and sedimentary rock in two main areas of the property, Lewis and ACMA deposits. The proven and probable reserves are 504.8 million metric tons (Mt), with an average grade of 2.09 grams per metric ton. With an estimated process plant recovery at approximately 90%, the operation would produce an average of over one million ounces of gold annually. Tailings storage would encompass an area of 2,351 acres, with a total capacity of approximately 334,300 acre-feet for tailings, reclaim water, and flood events. Total waste rock material is estimated to be 2,900 Mt, with approximately 2,232 Mt placed in a waste rock facility located outside the mine pit and the remaining waste rock backfilled in the pit or used in construction. The proposed Donlin Gold Project would be a camp operation accessible primarily by a 5,000 foot gravel airstrip. Other ancillary support facilities would be located within the Donlin Gold Project area.

2.2 Facility and Wastewater Description

The proposed Donlin Gold Project facility consists of the following major elements:

- An open pit mine;
- A process plant that concentrates gold bearing minerals from the ore through crushing and grinding, and flotation; followed by pressure oxidation and carbon-in-leach process circuits, then conventional carbon stripping and electrolytic gold recovery to produce gold doré bars;
- Anaconda Tailings Storage Facility (TSF) with an engineered dam, located in the Anaconda Creek drainage;
- Waste Rock Facility (WRF) for the disposal of waste rock, located in the American Creek drainage;
- Water management systems that maximize recycling and treat all waters affected by the Donlin Gold Project in accordance with pertinent federal and state legislation;
- On-site power generation and electrical distribution;
- Construction and permanent camp facilities with showers, lavatories and dining facilities; and,
- An assortment of shops, warehouses, and offices to support mine operations.

The permit authorizes the discharge of treated wastewater to Crooked Creek from Outfall 001. The proposed facility is expected to operate at a net positive water balance thus necessitating the need to discharge excess water. The location of Outfall 001 is shown on Figure 1. The water treatment plant (WTP) location and planned facility layout during operations are shown on Figure 4. The WTP will utilize oxidation, clarification and greensand filtration, with reverse osmosis (RO) polishing as required. A process flow diagram of the Operations WTP showing the flow through each treatment unit is included as Figure 5. The WTP will have a combined maximum design capacity of approximately 4,750 gallons per minute (gpm), with an anticipated maximum treatment rate of approximately 4,500 gpm.

Influent sources to the WTP will vary in flow over time and are dependent on the facility activities over the course of the life of mine (LOM) and include:

- Pit dewatering;
- TSF Seepage Recovery System (SRS);
- Contact Water Dams (CWD) located at the upper and lower ends of the WRF;
- TSF Pond;
- Domestic wastewater (contingency only);
- Incinerator scrubber water; and
- Storm water collected from areas not covered under another wastewater discharge authorization that does not report directly to the Contact Water Dams.

The maximum flow to the WTP from the dewatering wells will be approximately, 2,300 gpm, which is predicted to occur in the mid-point of LOM. Over the operations period a maximum seasonal rate of approximately 1,100 gpm from the CWDs, 44 gpm from the TSF, and approximately 800 gpm from the SRS would be treated. The maximum combined flow to the WTP is approximately 4,500 gpm, which is predicted to occur in the mid-point of LOM (approximately in Year 12 LOM). Maximum monthly flowrates from the influent sources for each year of operation were estimated from the water balance model.

The treatment process will include two feed equalization tanks. The first tank will exclusively receive feed from the pit dewatering wells with relatively good water quality, referred to as low mineralized wells. The second tank will collect the incoming feed from the CWD, SRS and TSF sources as well as from pit dewatering with relatively poor water quality, referred to as high mineralized wells. The first tank containing well water will feed Train #1. The second tank will ordinarily feed Trains #2 and Train #3. Blowers will supply air to the WTP feed tanks for mixing and to allow for iron oxidation. From the feed water tanks, the water in each train will be pumped to high rate clarifiers (HRCs). Sulfuric acid and ferric sulfate will be dosed in line ahead of the HRC to

adjust pH for the iron co-precipitation process. The pH and ferric sulfate dosage will be adjusted to optimize arsenic and antimony removal. In the HRC, a polymeric flocculent will be added to assist with the agglomeration of the precipitated ferric hydroxide and co-precipitates. The solids are separated in the clarification step. The overflow (treated water) from the HRC clarifier in each train will be collected in the clarified water transfer tank, and then pumped to the greensand media filters. The greensand media filters will be dual media filters. The top layer will be anthracite intended for TSS removal and the bottom layer will be the greensand media itself. Potassium permanganate ($KMnO_4$) will be injected upstream of the greensand filters to treat manganese. The greensand filters will be backwashed with air and water. Brine from the RO system will be used for backwash water. Wastewater from filter backwash will be sent to the Backwash Wastewater/Clarifier Sludge Receiver Tank. This combined wastewater will be pumped to the TSF or used in the process.

RO pre-treatment to protect the membranes from oxidation, scaling, and fouling includes antiscalant addition and a 5-micron absolute cartridge filtration system installed ahead of the RO system. The RO systems are designed to operate at 75% recovery. The brine from the RO process will be collected in the RO brine water tank. The majority of the water from the brine water tank will be pumped to the reclaim water tank for reuse in the process plant, while some will be discharged to the TSF and a small amount will be used for backwashing the greensand filters.

RO permeate will be discharged to the RO permeate water tank. Before entering the tank, the pH will be adjusted to within the discharge range (7.5 – 8) by addition of soda ash (Na_2CO_3) and to also increase the alkalinity of the treated water as required. It is not expected that RO treatment will be required for the higher quality pit dewatering well water being treated in Train #1. Typically discharge from the greensand filters in Train #1 will be directed to the RO permeate water tank. RO units will be available to be used in Train #1 as a back-up system when required to meet discharge standards. In normal operation, treated water from Trains 1, 2, and 3 will be pumped from the RO permeate water tank to the discharge outfall at Crooked Creek. If, for any reason, the treated water is out of compliance with permit limitations, then the water will be transferred to the Lower CWD until the problem is resolved.

A modular sanitary treatment plant (STP) system would be provided for the treatment and discharge of domestic wastewater from the permanent camp facilities about 2.4 miles west of the plant site that is anticipated to accommodate 638 people. A similar STP system would be provided for the process plant area. The discharges from these STPs are anticipated to be permitted under a general APDES permit (Permit Number AKG572000). As a contingency in the event of an upset condition or equipment failure, effluent from the STPs may be discharged into the TSF from which some water is ultimately routed to the WTP and discharged into Crooked Creek at Outfall 001. Bio-solids from the STPs would be incinerated after filter pressing to remove excess water.

2.3 Pollutants of Concern

Pollutants of concern were identified using Effluent Limitation Guidelines (ELGs) and water quality monitoring data for effluent and TSF water as provided by the applicant. See Appendix B for a detailed analysis of the pollutants of concern.

3.0 COMPLIANCE HISTORY

This APDES Permit issuance regulates a new wastewater discharge to surface water. Accordingly, no compliance history is available for this first-time APDES permitting action.

4.0 EFFLUENT LIMITS AND MONITORING REQUIREMENTS

4.1 Basis for Permit Effluent Limits

The Clean Water Act (CWA) requires that the limits for a particular pollutant be the more stringent of either technology-based effluent limits (TBELs) or water quality-based effluent limits (WQBELs). TBELs are set according to the level of treatment that is achievable using available technology. A WQBEL is designed to ensure that the Water Quality Standards (WQS) of a waterbody are met and may be more stringent than TBELs. Both TBELs (Code of Federal Regulations (CFR) 40 CFR § 440 adopted by reference in 18 AAC 83.010) and WQBELs are included in the permit. See APPENDIX B for further discussion of the technical and legal basis for the proposed effluent limits in the permit.

Outfall 001 is associated with the discharge of the following waters from the mine site: mine drainage and storm water from the CWDs, pit dewatering water, SRS water, excess precipitation from the TSF, and domestic wastewater from the STPs (contingency only as described in Section 2.2). The Environmental Protection Agency (EPA) promulgated effluent limitation guidelines (ELGs) for the ore mining and dressing point source category at 40 CFR Part 440, which include TBELs for this point source category, adopted by reference in 18 AAC 83. Subpart J is applicable to the Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores Subcategory. The ELGs in Subpart J are applicable to the discharge from Outfall 001.

The ELGs applicable to a new source, which is a source that has commenced construction after the ELGs were established on December 3, 1982, are applicable to the subject discharges from active mines. Table 1 identifies the parameters and TBELs required for Outfalls 001 found in 40 CFR Part 440. See APPENDIX B through APPENDIX D for more details on the selection of the final permit limits.

Table 1: Technology-Based Effluent Limits for Outfall 001 [40 CFR § 440.104(a)]

Parameter	Units	Maximum for any 1 day	Average of daily values for 30 consecutive days	Range
Cadmium	mg/L [a]	0.10	0.05	-
Copper	mg/L	0.30	0.15	-
Lead	mg/L	0.6	0.3	-
Mercury	mg/L	0.002	0.001	-
Zinc	mg/L	1.5	0.75	-
pH	s.u. [b]	-	-	6.0-9.0
Total Suspended Solids (TSS)	mg/L	30.0	20.0	-

a. Milligrams per liter.
b. Standard units.

4.2 Basis for Effluent and Receiving Water Monitoring

In accordance with AS 46.03.110(d), the Department may specify in a permit the terms and conditions under which waste material may be disposed. Monitoring in a permit is required to determine

compliance with effluent limits. Monitoring may also be required to gather effluent and receiving water data to determine if additional effluent limits are required and/or to monitor effluent impact on the receiving waterbody quality. The permittee is responsible for conducting the monitoring and for reporting results electronically on Discharge Monitoring Reports (DMRs) or on the application for reissuance, as identified in the permit, to the Department. Fact Sheet sections 4.3 through 0 summarize monitoring and reporting requirements DEC has determined necessary to implement in the permit (additional discussion about the basis for monitoring requirements can be found in 10.0APPENDIX B through APPENDIX D).

4.3 Monitoring Requirements

The permit contains effluent limits that are based on the most stringent of either TBELs or WQBELs. Table 2 summarizes the proposed effluent limits for Outfall 001. (Please see APPENDIX B for more details regarding the legal and technical basis surrounding the selection of effluent limits.)

The permit contains effluent limits applied at an internal outfall for domestic wastewater discharged into the the TSF from the STPs, designed to treat domestic wastewater from the permanent accommodations facility for facility for up to 638 personnel. Domestic wastewater monitoring and effluent limits are applied to internal internal Outfall 010. The Permittee is required to monitor discharges from the STP at an internal monitoring monitoring location immediately downstream of the last treatment process of the STP (designated as Outfall Outfall 010) for the parameters specified in

Table 3 when discharging to the TSF.

For all monitoring, the permittee must use a sufficiently sensitive Environmental Protection Agency (EPA) approved test method that quantifies the level of pollutants to a level lower than applicable limits or water quality standards or use the most sensitive Title 40 CFR Part 136 (Guidelines Establishing Test Procedures for the Analysis of Pollutants), adopted by reference at 18 AAC 83.010(f), test method available.

Under Permit Part 1.2.10, through written request by the permittee and Department written approval, the Department will reduce the monitoring frequency for a parameter with a weekly monitoring requirement to monthly if a reasonable potential analysis, using 52 weeks of effluent data, indicates no reasonable potential to exceed water quality criteria for that parameter. The reasonable potential analysis must follow the procedure described in the *APDES Permits Reasonable Potential Analysis and Effluent Limits Development Guide* (RPA Guidance, 2014). This approach does not require major permit modification under 18 AAC 83 given the specific monitoring reduction and the criteria for doing so was clearly spelled out in the original permitting action. Additional effluent monitoring reductions based on effluent performance data collected during the permit cycle may result in additional monitoring reductions being contemplated at permit reissuance.

The establishment, if necessary, of a site-specific method detection limit/method limit (MDL/ML) for WAD cyanide in the APDES Permit is authorized. During the life of this permit, a new or revised site specific MDL and/or ML for WAD cyanide unique to a site specific water chemistry may be established in accordance with 18 AAC 70.020(c)(7) and EPA guidance document no. EPA-821-B-04-005. Upon the effective date of the Department-approved MDL and/or ML, this permit is considered to be automatically modified to require reporting of measurements below, at or above the Department-approved site specific MDL and/or ML in accordance with Permit Section 1.2.7.

Table 2: Outfall 001: Effluent Limits and Monitoring Requirements

Parameter[a]	Maximum Daily Limit	Average Monthly Limit	Units	Minimum Sample Frequency	Sample Type
Aluminum	140	71	µg/L [c]	1/Week	24-hour Composite
Ammonia as Nitrogen	6.9	2.6	mg/L [i]	1/Week	24-hour Composite
Antimony	12	6.0	µg/L	1/Week	24-hour Composite
Arsenic	20	10	µg/L	1/Week	24-hour Composite
Barium	4,000	2,000	µg/L	1/Week	24-hour Composite
Beryllium	8.0	4.0	µg/L	1/Week	24-hour Composite
Cadmium [b]	0.4	0.2	µg/L	1/Week	24-hour Composite
Copper [b]	12	6.1	µg/L	1/Week	24-hour Composite
Cyanide [d]	8.5	4.3	µg/L	1/Week	24-hour Composite
Dissolved Organic Carbon	Monitoring only		µg/L	1/Week	Grab
Fluoride	2,000	1,000	µg/L	1/Week	24-hour Composite
Hardness, as $CaCO_3$	Monitoring only		mg/L	1/Week	Grab
Iron	Monitoring only		µg/L	1/Week	24-hour Composite
Lead [b]	4.3	2.2	µg/L	1/Week	24-hour Composite
Manganese	100	50	µg/L	1/Week	24-hour Composite
Mercury [e]	0.020	0.0098	µg/L	1/Week	24-hour Composite
Molybdenum	20	10	µg/L	1/Week	24-hour Composite
Nitrate as N	20,000	10,000	µg/L	1/Week	24-hour Composite
Outfall Flow	4,500	Not applicable	gpm [h]	Continuous	Recording
pH	6.5-8.5		s.u. [g]	Continuous	Recording
Selenium	8.2	4.1	µg/L	1/Week	24-hour Composite
Silver [b]	2.9	1.5	µg/L	1/Week	24-hour Composite
Sulfate	500	250	mg/L	1/Week	24-hour Composite
Temperature	Monitor only		°C [k]	1/Week	Grab
Thallium	3.4	1.7	µg/L	1/Week	24-hour Composite
Total Dissolved Solids	1,000	500	mg/L	1/Week	24-hour Composite
Total Suspended Solids	30	20	mg/L	1/Week	24-hour Composite
Turbidity, effluent	See Permit Part 1.2.3		NTU [f]	1/Week	Grab
Turbidity, background	See Permit Part 1.2.3		NTU	1/Week	Grab
Whole Effluent Toxicity (WET)	See Permit Part 1.4		TU_c [j]	1/Quarterly	Grab
Zinc [b]	110	53	µg/L	1/Week	24-hour Composite

a. All metals shall be measured as total recoverable unless otherwise noted.

b. Hardness-based limits using a hardness of 86 mg/L $CaCO_3$, the 15th percentile of background data.

Table 2: Outfall 001: Effluent Limits and Monitoring Requirements

Parameter[a]	Maximum Daily Limit	Average Monthly Limit	Units	Minimum Sample Frequency	Sample Type
c. Micrograms per liter. d. Cyanide must be analyzed as weak acid dissociable (WAD) cyanide. e. Mercury must be analyzed and reported as total. f. Nephelometric turbidity units. g. Standard units. See Permit Part 1.2.5. h. Gallons per minute. i. Milligrams per liter. j. Chronic toxic units. k. Degrees centigrade.					

Table 3: Internal Outfall 010 Domestic Wastewater Effluent Limits and Monitoring Requirements

Parameter	Units	Effluent Limits			Monitoring Requirements		
		Average Monthly	Average Weekly	Maximum Daily	Sample Location	Minimum Frequency	Sample Type
Flow	gpd [a]	Monitor only	Not applicable	Monitor only	Effluent	1/Month	Measured
Biological Oxygen Demand (BOD_5)	mg/L	30	45	60	Effluent	1/Month	Grab
BOD_5 Percent Removal [b]	%	85	Not applicable	Not applicable	Influent and Effluent [c]	1/Month	Grab
TSS	mg/L	30	45	60	Effluent	1/Month	Grab
TSS Percent Removal [b]	%	85	Not applicable	Not applicable	Influent and Effluent [c]	1/Month	Grab
Chlorine, Total Residual	µg/L	11	Not applicable	19	Effluent	1/Month	Grab
E. Coli e [d f]	Cfu/100 mL	126	Not applicable	410 [g]	Effluent	1/Month	Grab
Fecal Coliform (FC) [d e]	FC/100 mL	20	Not applicable	40 [e]	Effluent	1/Month	Grab
pH	Standard units	6.0 to 9.0			Effluent	1/Month	Grab

a. Gallons per day.

b. Minimum % Removal = [(monthly average influent concentration in mg/L - monthly average effluent concentration in mg/L) / (monthly average influent concentration in mg/L)] x 100.The monthly average percent removal must be calculated using the arithmetic mean of the influent value and the arithmetic mean of the effluent value for that month.

c. Influent and effluent samples must be taken within 15 minutes from each other.

d. When more than one sample is collected in a month, the FC, enterococci and E. coli average results must be reported as the geometric mean. When calculating the geometric mean, replace all results of zero, 0, with a one, 1. The geometric mean of "n" quantities is the "nth" root of the quantities. For example the geometric mean of 100, 200, and 300 is (100 x 200 x 300)1/3= 181.7.

e. Not more than one sample, or if more than ten FC bacteria samples are collected during the monthly reporting period, not more than 10% of the samples may exceed 40 FC/100 mL.

f. Sampling required once per month only during the time period May-Sept. Sampling should be conducted at the same time as FC sampling.

g. Not more than one sample, or if more than ten E. coli bacteria samples are collected during the reporting period, not more than 10% of the samples may exceed a statistical threshold value (STV) of 410 cfu/100 mL.

4.4 Whole Effluent Toxicity Monitoring

18 AAC 83.435 requires that a permit contain limitations on WET when a discharge has reasonable potential to cause or contribute to exceedances of Alaska Water Quality Standards (WQS). The permit does not establish WET limits because no effluent monitoring data for WET are currently available for a determination of reasonable potential to cause or contribute to an exceedance of the chronic WET numeric water quality criterion. The permit requires quarterly WET monitoring. The data from these tests will be used to determine whether there is a reasonable potential to exceed the chronic WET water quality criterion found in 18 AAC 70.030 and could be used to establish WET limits in future permitting actions. A WET monitoring frequency reduction may be requested by the permittee and granted by written Department approval if WET results from twelve consecutive quarterly samples demonstrate that the effluent discharge does not exceed toxicity at the maximum dilution concentration of 6.25%.

WET tests are laboratory tests that measure total toxic effect of an effluent on living organisms. The tests use small vertebrate and invertebrate species and/or plants to measure the aggregate toxicity of an effluent. Chronic toxicity tests measure reductions in survival, growth, and reproduction over a 7-day or 48 hour exposure. Chronic toxicity monitoring shall be conducted by the permittee according to the methods and species approved by the EPA in *Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition,* (EPA/821-R-02-013, October 2002).

The permit requires the permittee to perform quarterly chronic toxicity tests on samples representative of the effluent discharged from Outfall 001. The permit further stipulates that during the first year of discharge, tests shall be conducted using fathead minnows, Pimephales promelas - static, renewal, larval survival, and growth test; water fleas, Ceriodaphnia dubia - 7-day static renewal, survival, and reproduction test; and green algae, Selanastrum capricornutum - 4-day static and growth. The remainder of the tests shall be conducted using the most sensitive species. If no toxicity is observed in the chosen species, testing shall be conducted on the fathead minnow. The presence of chronic toxicity is determined as specified in EPA/821-R-02-013, October 2002.

If WET results from twelve consecutive quarters demonstrate that the effluent discharge does not exceed toxicity at the maximum dilution concentration of 6.25%, the Department may reduce the monitoring frequency to twice yearly.

4.5 Receiving Waterbody Monitoring Requirements

The permit requires receiving waterbody monitoring in Crooked Creek that receives discharge from a point source at Outfall 001. Receiving water monitoring is required to verify that the designated uses for the receiving waterbody are protected from the pollutants of concern. Receiving water sampling must be conducted quarterly (minimum). Monitoring is conducted both upstream and downstream of any mining related disturbance. Receiving water monitoring was established to monitor for the parameters of concern in Table 4 to be taken at locations listed in Table 5.

Table 4. Receiving Water Monitoring Parameters

Parameter [a]	Units	Minimum Sample Frequency	Sample Type
Aluminum	µg/L	1/Quarter	Grab
Ammonia as N	µg/L	1/Quarter	Grab
Antimony	µg/L	1/Quarter	Grab
Arsenic	µg/L	1/Quarter	Grab
Beryllium	µg/L	1/Quarter	Grab
Cadmium	µg/L	1/Quarter	Grab
Color	Color units	1/Quarter	Grab
Conductivity	µS/cm [b]	1/Quarter	Grab
Copper	µg/L	1/Quarter	Grab
Cyanide, Weak Acid Dissociable	µg/L	1/Quarter	Grab
Fluoride	µg/L	1/Quarter	Grab
Hardness, as $CaCO_3$	mg/L	1/Quarter	Grab
Iron	µg/L	1/Quarter	Grab
Lead	µg/L	1/Quarter	Grab
Manganese	µg/L	1/Quarter	Grab
Mercury	µg/L	1/Quarter	Grab
Molybdenum	µg/L	1/Quarter	Grab
Nitrate, as N	mg/L	1/Quarter	Grab
pH	s.u.	1/Quarter	Grab
Selenium	µg/L	1/Quarter	Grab
Silver	µg/L	1/Quarter	Grab
Sulfate, Total	mg/L	1/Quarter	Grab
Temperature	°C [c]	1/Quarter	Grab
Thallium	µg/L	1/Quarter	Grab
Total Dissolved Solids	mg/L	1/Quarter	Grab
Total Suspended Solids	mg/L	1/Quarter	Grab
Turbidity	NTU	1/Quarter	Grab
Zinc [b]	µg/L	1/Quarter	Grab

Notes:

a. Must be measured as total or total recoverable.
b. Microsiemens per centimeter.
c. Degrees centigrade.

Table 5. Receiving Water Monitoring Stations

Station Identification (ID)	Station Name and Description
CCBC	Crooked Creek below Crevice Creek
CCBW	Crooked Creek below Lyman's Wash Plant

4.6 Reporting Requirements

The permit requires the following reports to be submitted to the Department, summarized in Table 6:

Table 6: Schedule of Submissions

Permit Part	Submittal or Completion	Frequency	Due Date	Submit to [a]
Error! Reference source not found.	Whole Effluent Toxicity (WET) test results	Quarterly	Must be submitted with the first eDMR following receipt of the test results.	Compliance
Error! Reference source not found. 1.5.11	Annual Water Quality Report Receiving water monitoring results	Annually	March 1st of the next year	Compliance
Error! Reference source not found.	Quality Assurance Project Plan (QAPP)	1/permit cycle	90 days prior to commencement of the first actual discharge	Compliance
Error! Reference source not found.	Written notification that the Best Management Practices (BMP) Plan has been implemented	1/permit cycle	90 days prior to commencement of the first actual discharge	Compliance
Error! Reference source not found.	BMP Plan Annual Review Certification	Annually	January 31st of the next year	Compliance
Appendix A, 1.3	Application for Permit Reissuance	1/permit cycle	180 days before expiration of the permit	Permitting
Appendix A, 3.2	DMR	Monthly	Submitted electronically through the Net DMR system on or before the 28th day of the next month [c]	Compliance
Appendix A, 3.4	Oral notification of noncompliance [b]	As Necessary	Within 24 hours of discovering noncompliance	Compliance
Appendix A, 3.4	Written documentation of noncompliance	As Necessary	Within 5 days of discovering noncompliance	Compliance

a) See Appendix A 1.1 for addresses
b) Oral notifications must be reported to the Department's noncompliance reporting hotline: 1-907-269-4114 (from Alaska) or 1-877-569-4114 (nationwide).
c) This due date and electronic submittal requirement per Permit Part 2.3 supersedes the date shown in Permit Appendix A – Standard Conditions, Section 3.2.

5.0 RECEIVING WATERBODY

5.1 Description of Receiving Waterbody

Crooked Creek is the main drainage course of the area which receives flow from the following watersheds along Crooked Creek, including; Dome Creek, Quartz Gulch, Snow Creek, Queen Gulch, Lewis Gulch, American Creek, Omega Gulch, Anaconda Creek, Grouse Creek, Unnamed Creeks/Gulches and Crevice Creek (Figure 1). Crooked Creek ultimately flows into the Kuskokwim River and has a drainage area of approximately 347 square miles.

5.2 Outfall Location

The Donlin Gold Project is proposing to discharge treated effluent through an open-pipe into freshwaters of Crooked Creek at latitude 62.019278° North by longitude -158.254519° West which is located below the confluence of Omega Gulch and above the confluence of Anaconda Creek (Figure 1).

5.3 Water Quality Standards

Regulations in 18 AAC 70 require that the conditions in permits ensure compliance with the WQS. The state's WQS are composed of use classifications, numeric and/or narrative water quality criteria, and an Antidegradation Policy. The use classification system designates the beneficial uses that each waterbody is expected to achieve. The numeric and/or narrative water quality criteria are the criteria deemed necessary by the state to support the beneficial use classification of each waterbody. The Antidegradation Policy ensures that the beneficial uses and existing water quality are maintained.

Water bodies in Alaska are designated for all uses unless the water has been reclassified under 18 AAC 70.230 as listed under 18 AAC 70.230(e). Some water bodies in Alaska can also have site–specific water quality criterion per 18 AAC 70.235, such as those listed under18 AAC 70.236(b).

Crooked Creek, near Outfall 001, has not been reclassified pursuant to 18 AAC 70.230, nor does it have site-specific water quality criteria pursuant to 18 AAC 70.235. Therefore, Crooked Creek, near Outfall 001, must be protected for all freshwater designated uses classes listed in 18 AAC 70.020(a)(1). These freshwater designated uses consist of the following: water supply for water supply, water recreation and growth and propagation of fish, shellfish, other aquatic life, and wildlife; and harvesting for consumption of raw mollusks or other raw aquatic life. Further description of the designated use classes applicable to Crooked Creek is described in Fact Sheet Appendix B, Section B-III.A.

5.4 Water Quality Status of Receiving Water

Any part of a waterbody for which the water quality does not or is not expected to meet applicable WQS is defined as a "water quality limited segment" and placed on the state's impaired waterbody list. For an impaired waterbody, Section 303(d) of the Clean Water Act (CWA) requires states to develop a Total Maximum Daily Load (TMDL) management plan for a waterbody determined to be water quality limited. The TMDL documents the amount of a pollutant a waterbody can assimilate without violating a state's WQS and allocates that load to known point sources and nonpoint sources.

Crooked Creek is not included on the *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report*, July 15, 2010, as an impaired waterbody, nor is the waterbody listed as a CWA 303(d) waterbody requiring a TMDL. Accordingly, a TMDL has not been prepared for the subject waterbody.

5.5 Mixing Zone Analysis

No mixing zone is authorized under the permit.

6.0 ANTIBACKSLIDING

18 AAC 83.480 requires that "effluent limitations, standards, or conditions must be at least as stringent as the final effluent limitations, standards, or conditions in the previous permit." 18 AAC 83.480(c) also states that a permit may not be reissued "to contain an effluent limitation that is less stringent than required by effluent guidelines in effect at the time the permit is renewed or reissued." This permit is the first issuance of an APDES permit for the Donlin Gold Project, therefore, effluent limits are newly established, and further antibacksliding requirements are not applicable and an analysis is not warranted.

7.0 ANTIDEGRADATION

Section 303(d)(4) of the CWA states that, for water bodies where the water quality meets or exceeds the level necessary to support the waterbody's designated uses, WQBELs may be revised as long as the revision is consistent with the State's Antidegradation Policy. The Antidegradation Policy of the WQS (18 AAC 70.015) states that the existing water uses and the level of water quality necessary to protect existing uses must be maintained and protected. This section analyzes and provides rationale for the Department's decisions in the permit issuance with respect to Antidegradation Policy.

The Department's approach to implementing the Antidegradation Policy, found in 18 AAC 70.015, is based on the requirements in 18 AAC 70 and the Department's *Policy and Procedure Guidance for Interim Antidegradation Implementation Methods*, dated July 14, 2010. Using these procedures and policy, the Department determines whether a waterbody, or portion of a waterbody, is classified as Tier 1, Tier 2, or Tier 3, where a higher numbered tier indicates a greater level of water quality protection. At this time, no Tier 3 waters have been designated in Alaska.

Crooked Creek is not listed as impaired on DEC's most recent *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report*; therefore, a Tier 1 designation is not warranted. Accordingly, this antidegradation analysis conservatively assumes that the discharge is to a Tier 2 waterbody.

The State's Antidegradation Policy in 18 AAC 70.015(a)(2) states that if the quality of water exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water (i.e. Tier 2 waters), that quality must be maintained and protected. The Department may allow a reduction of water quality only after finding that five specific requirements of the Antidegradation Policy at 18 AAC 70.015(a)(2)(A – E) are met. The Department's findings follow:

1. **18 AAC 70.015 (a)(2)(A).** *Allowing lower water quality is necessary to accommodate important economic or social development in the area where the water is located.*

   Based on the evaluation required per 18 AAC 70.015(a)(2)(D) below, the Department has determined that the most reasonable and effective pollution prevention, control, and treatment methods are being used and that the localized lowering of water quality is necessary to accommodate important economic and social development.

   The Donlin Gold Project proposes to develop the mineral potential of lands selected by the Calista Corporation under the provisions of the Alaska Native Claims Settlement Act (ANCSA). These lands were selected specifically because of their mineral potential and Calista is mandated by ANCSA to develop the lands for the benefit of its shareholders and, as a result of the ANCSA Sections 7(i) and 7(j) revenue sharing provisions, for the benefit of the shareholders of all Alaska Native corporations. In addition to the social and economic benefits that Donlin Gold will provide to Alaska Native corporations and their shareholders, the Donlin Gold Project also will have a major, positive social and economic

impact on the Yukon-Kuskokwim (Y-K) region – one of the most economically challenged areas in the U.S. as a whole. These benefits will result from the payments made to Calista under the mining lease with Donlin Gold; the payments made to The Kuskokwim Corporation (TKC), which owns the surface estate, under the surface use agreement with Donlin Gold; the wages paid to employees who live in the Y-K region, the purchases made from businesses in the Y-K region, and the indirect social and economic effects of these direct payments.

The Donlin Gold Project would create an estimated 3,000 jobs during the 3-4 year construction period. During the 27-year operational period, approximately 1,200 full-time employees would be required. Beyond direct employment benefits, for each year the Donlin Gold Project is operational, an estimated 650 jobs and $40 million in wages would be generated statewide through multiplier effects, while sales within the state would increase by $150 million per year. Both the direct and indirect economic activity would generate tax revenues for State and local governments. Section 3.18 of the Donlin Gold Project Draft Environmental Impact Statement (USACE 2015) provides more detailed information on the social and economic benefits of the Donlin Gold Project.

During the mine construction period, Donlin Gold will pump wells to dewater the area of the proposed open pit. During the construction period, the Donlin Gold Project will have limited need for water, so the majority of the pumped water must be discharged. During operations, the Donlin Gold Project will maximize the re-use of water in the process plant and other on-site applications. In addition, a wide range of measures will be employed to limit the volume of fresh water that contacts mine facilities. However, even with the implementation of these measures, the Donlin Gold Project is still projected to operate with a net water surplus over the life-of-the-mine. Treatment and discharge through Outfall 001 is an essential component of the Project's water management plan that will reduce the volume of water that must be managed during the Project's operational and closure periods.

The Department concludes that the operation of the facility and the authorization of the discharge accommodates important social and economic development in Alaska and the Interior region of the State and the anticipated lowering of water quality is necessary for these purposes and that the finding is met.

2. **18 AAC 70.015 (a)(2)(B).** *Except as allowed under this subsection, reducing water quality will not violate the applicable criteria of 18 AAC 70.020 or 18 AAC 70.235 or the whole effluent toxicity limit in 18 AAC 70.030.*

   The permit requires that the discharge shall not cause a violation of the WQS at 18 AAC 70 except if excursions are authorized in accordance with provisions in 18 AAC 70.200 – 70.270 (i.e., mixing zone, variance, etc.).

   Actual effluent data do not exist for the Donlin Gold Project. WTP effluent quality was estimated using conservative estimates of source water quality and data and best engineering judgment of treatment efficiency. Maximum expected effluent concentrations (MECs) were then derived using the highest calculated effluent concentration and the application of a conservative Coefficient of Variability and a conservative Reasonable Potential Multiplier. All chemical parameters with limits in Table 2, with the exception of TSS and WET, were determined to have reasonable potential to exceed WQS at the point of discharge. The relatively high number of parameters with reasonable potential is due to the conservative application of the MECs. Thus, effluent limits and corresponding monitoring was developed. The resulting effluent end-of-pipe limits and monitoring requirements in the permit protect water quality criteria, and therefore, will not violate water quality criteria found at 18 AAC 70.020.

   There are no site-specific criteria associated with 18 AAC 70.235 that apply to the discharge and associated waterbody.

   The permit does not include WET limits but does require quarterly monitoring and reporting consistent with 18 AAC 70.030. Compliance with applicable parameter-specific water quality criterion are protective of aquatic life uses at Outfall 001. The WET test monitoring results and any future WET

limits set during a future permit reissuance, if determined necessary to control the discharge to ensure compliance with the chronic WET criterion, will further ensure that the aquatic life resources are protected. Compliance with applicable WQS are protective of aquatic life uses at Outfall 001 and will ensure that these WET limits will be met. In addition, it has been shown that aquatic species subject to WET tests often require some levels of essential minerals. By not using RO to treat all the pit perimeter well water, some of the natural minerals and the associated ionic balance will be maintained in the effluent. This will further ensure the health and survivability of the organisms that use in Crooked Creek.

DEC determined that the reduction in water quality will not violate the criteria of 18 AAC 70.020, 18 AAC 70.235, or 18 AAC 70.030, and that the finding is met.

3. **18 AAC 70.015(a)(2)(C).** *The resulting water quality will be adequate to fully protect existing uses of the water.*

   The WQS serve the specific purpose of protecting the existing uses of the receiving waterbody. Crooked Creek is protected for all designated uses (see Fact Sheet section 5.3); therefore, the most stringent water quality criteria found in 18 AAC 70.020 and in the Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances (DEC 2008) were selected for use in the reasonable potential analysis for the wastewater discharge effluent.

   DEC determined that wastewater treatment at the Donlin Gold Project will result in adequate water quality to fully protect existing uses of the waterbody and that the finding is met.

4. **18 AAC 70.015(a)(2)(D).** *The methods of pollution prevention, control, and treatment found by the department to be most effective and reasonable will be applied to all wastes and other substances to be discharged.*

   EPA promulgated ELGs for the ore mining and dressing point source category at 40 CFR Part 440, Subpart J. The parameters and TBELs required for Outfall 001 are described in Section 4.1 of the Fact Sheet. An evaluation of estimated effluent data indicates that treated water at Outfall 001 will exceed minimum treatment performance requirements of the ELGs applicable to this facility.

   The permittee is required to implement a best management practices (BMP) plan. Through implementation of the BMP plan, the Permittee must prevent or minimize the generation and potential for release of pollutants from the facility to the lands and waters of the State as well as waters of the U.S. through normal and ancillary activities. The BMP plan includes pollution prevention measures and controls appropriate for each facility. Permit Part 2.2.6 requires the permittee to annually review and update the BMP plan and prepare and submit a certified statement that reviews have been completed and the BMP plan fulfills the requirements set forth in the permit. This statement must be signed and submitted to the Department.

   The permittee is required to maintain and operate wastewater treatment systems that discharge through Outfall 001. The engineering design and projected operation of the water treatment facilities are subject to Department review and approval prior to discharge. A description of the water treatment facilities for Outfall 001 is summarized in Fact Sheet Section 2.2. Projected WTP performance estimates indicate that effluent concentrations will be in compliance with permit effluent limits.

   The Department finds that the most effective methods of prevention, control, and treatment are the practices and requirements set out in the permit. The Department finds this criterion is met.

5. **18 AAC 70.015(a)(2)(E).** *All wastes and other substances discharged will be treated and controlled to achieve (i) for new and existing point sources, the highest statutory and regulatory requirements; and (ii) for nonpoint sources, all cost-effective and reasonable best management practices*.

The applicable "highest statutory and regulatory treatment requirements" are defined in 18 AAC 70.990(30) (as amended June 26, 2003) and in the Implementation Methods. Accordingly, there are three parts to the definition, which are:

- (A) any federal technology-based effluent limitation guidelines (ELG) identified in 40 CFR § 125.3 and 40 CFR § 122.29, as amended through August 15, 1997, adopted by reference at 18 AAC 83.010(c)(9);
- (B) minimum treatment standards in 18 AAC 72.040; and
- (C) any treatment requirement imposed under another state law that is more stringent than a requirement of this chapter.

The first part of the definition includes all applicable federal technology-based ELGs. EPA promulgated ELGs for the Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores point source category at 40 CFR Part 440 Subpart J (adopted by reference at 18 AAC 83.010(g)(3)). The ELGs applicable to a new source, which is a source that has commenced construction after the ELGs were established on December 3, 1982, are applicable to discharges from active mines, and these ELGs apply to Outfall 001.

Applicable New Source Performance Standards (NSPS) are found at 40 CFR Part 440, Subpart J. As documented in Table 7, the discharge will comply with the applicable requirements of this Subpart.

Table 7: Comparison of Maximum Predicted Effluent Concentration to NSPS Standards

Parameter (Total)	Maximum Predicted Effluent Concentration (mg/L)	NSPS Daily Maximum/Monthly Average Limits (mg/L)
Cadmium	0.0001	0.1/0.05
Copper	<0.001	0.30/0.15
Lead	<0.001	0.6/0.3
Mercury	<0.000012	0.002/0.001
Zinc	<0.02	1.0/0.5

The second part of the definition 18 AAC 70.990(B) (2003) appears to be in error, as 18 AAC 72.040 describes discharges to sewers and not minimum treatment. The correct reference appears to be the minimum treatment standards found at 18 AAC 72.050, which refers to domestic wastewater discharges only. The permit authorizes treated domestic wastewater effluent as a wastewater source from a domestic wastewater treatment plant and stipulates limits and monitoring requirements that meet the minimum treatment standards in 18 AAC 72.050.

The third part includes any more stringent treatment required by state law, including 18 AAC 70 and 18 AAC 72. Neither the regulations in 18 AAC 15 and 18 AAC 72 nor another state law that the Department is aware of impose more stringent requirements than those found in 18 AAC 70.

After review of the applicable statutory and regulatory requirements, including 18 AAC 70, 18 AAC 72, and 18 AAC 83, the Department finds that the wastewater discharge meets the highest applicable statutory and regulatory requirements and that this finding is met.

8.0 OTHER PERMIT CONDITIONS

8.1 Quality Assurance Project Plan

The permittee is required to develop procedures to ensure that the monitoring data submitted are accurate and to explain data anomalies if they occur. The permittee is required to update and submit the Quality Assurance Project Plan (QAPP) to the Department at least 90 days prior to commencement of the first actual discharge. The QAPP shall consist of standard operating procedures the permittee must follow for collecting, handling, storing and shipping samples; laboratory analysis; and data reporting. The plan shall be retained on site and made available to the Department upon request.

8.2 Best Management Practices Plan

In accordance with AS 46.03.110(d), the Department may specify in a permit the terms and conditions under which waste material may be disposed of. The permit requires the permittee to develop a BMP plan in order to prevent or minimize the potential for the release of pollutants to waters and lands of the State of Alaska through plant site runoff, spillage or leaks, or erosion. The permit contains certain BMP conditions that must be included in the BMP plan. The permit requires the permittee to develop or update and implement a BMP plan at least 90 days prior to commencement of the first actual discharge. The Plan must be kept on site and made available to the Department upon request.

8.3 Electronic Reporting (E-Reporting) Rule

The permittee must submit DMR data electronically through NetDMR per Phase I of the E-Reporting Rule (40 CFR 127) upon the effective date of the permit. Authorized persons may access permit information by logging into the NetDMR Portal (https://cdxnodengn.epa.gov/oeca-netdmr-web/action/login). DMRs submitted in compliance with the E-Reporting Rule are not required to be submitted as described in permit APPENDIX A – Standard Conditions unless requested or approved by the Department. Any DMR data required by the Permit that cannot be reported in a NetDMR field (e.g. mixing zone receiving water data, etc.), shall be included as an attachment to the NetDMR submittal. DEC has established an e-Reporting Information website at http://dec.alaska.gov/water/Compliance/EReportingRule.htm that contains general information about this new reporting format. Training materials and webinars for NetDMR can be found at https://netdmr.zendesk.com/home.

Phase II of the E-Reporting rule will integrate electronic reporting for all other reports required by the Permit (e.g., Annual Reports and Certifications) and implementation is expected to begin December 2020. Permittees should monitor DEC's E-Reporting Information website (http://dec.alaska.gov/water/Compliance/EReportingRule.htm) for updates on Phase II of the E-Reporting Rule and will be notified when they must begin submitting all other reports electronically. Until such time, other reports required by the Permit may be submitted in accordance with APPENDIX A – Standard Conditions.

8.4 Standard Conditions

Appendix A of the permit contains standard regulatory language that must be included in all APDES permits. These requirements are based on the regulations and cannot be challenged in the context of an individual APDES permit action. The standard regulatory language covers requirements such as monitoring, recording, reporting requirements, compliance responsibilities, and other general requirements.

9.0 OTHER LEGAL REQUIREMENTS

9.1 Endangered Species Act

The Endangered Species Act (ESA) requires federal agencies to consult with the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) if their actions could beneficially or adversely affect any threatened or endangered species. As a state agency, DEC is not required to consult with USFWS or NMFS regarding permitting actions. However, DEC values input from the Services on ESA concerns. DEC solicited USFWS and NMFS for feedback about ESA impacts associated with the permit and has not received a response. The U.S. Army Corps of Engineers (COE) also solicited NMFS and USFWS under the EIS, Section 7 consultation for the entire Donlin Gold Project area. USFWS issued a letter agreeing with the Corp's findings of no adverse effects on ESA species under the USFWS jurisdiction.

9.2 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires federal agencies to consult with NMFS when any activity proposed to be permitted, funded, or undertaken by a federal agency has the potential to adversely affect (reduce quality and/or quantity of) Essential Fish Habitat (EFH). EFH includes the waters and substrate (sediments, etc.) necessary for fish from commercially-fished species to spawn, breed, feed, or grow to maturity.

As a state agency, DEC is not required to consult with NMFS regarding permitting actions. However, DEC is concerned with protecting EFH. DEC solicited NMFS for feedback on EFH impacts associated with the permit and has not received a response. The COE also solicited NMFS and USFWS under the EIS, Section 7 consultation for the entire Donlin Gold Project area. NMFS responded with four recommendations; however, none of the recommendations effect the conditions of the APDES permit.

9.3 Permit Expiration

The permit will expire five years from the effective date of the permit.

10.0 References

DEC (Alaska Department of Environmental Conservation), 2010. "Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report," July 15, 2010.

DEC, 2014. Alaska Pollutant Discharge Elimination System (APDES) Permits Reasonable Potential Analysis and Effluent Limits Development Guide, June 30, 2014.

DEC, 2008. Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances, as amended through December 12, 2008.

DEC, 2010. "Interim Antidegradation Implementation Methods," Policy and Procedure 05.03.103, July 14, 2010.

Johnson, J., and V. Litchfield. 2016. Catalog of waters important for spawning, rearing, or migration of anadromous fishes – Arctic Region, Effective June 1, 2016. Alaska Department of Fish and Game, Special Publication No. 16-01, Anchorage.

NOAA (National Oceanic and Atmospheric Administration), National Marine Fisheries Service, Habitat Conservation, "Essential Fish Habitat Mapper," <http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html>, accessed on April 20, 2016.

COE (U.S. Army Corps of Engineers) 2015, Donlin Gold Project Draft Environmental Impact Statement, November, http://donlingoldeis.com/EISDocuments.aspx.

USEPA (United State Environmental Protection Agency), 1991. Technical Support Document for Water Quality-based Toxics Control, EPA/505/2-90-001, USEPA Office of Water, Washington, DC, March 1991.

USEPA, 1993. Guidance Manual for Developing Best Management Practices (BMP), EPA 833-B-93-004, USEPA Office of Water, October 1993.

USEPA, 2010. National Pollutant Discharge Elimination System Permit Writer's Manual, EPA-833-K-10-001, USEPA Office of Water Management, Water Permits Division, Washington, DC, September 2010.

APPENDIX A. FACILITY INFORMATION

Figure 1: Donlin Gold Project Location Map

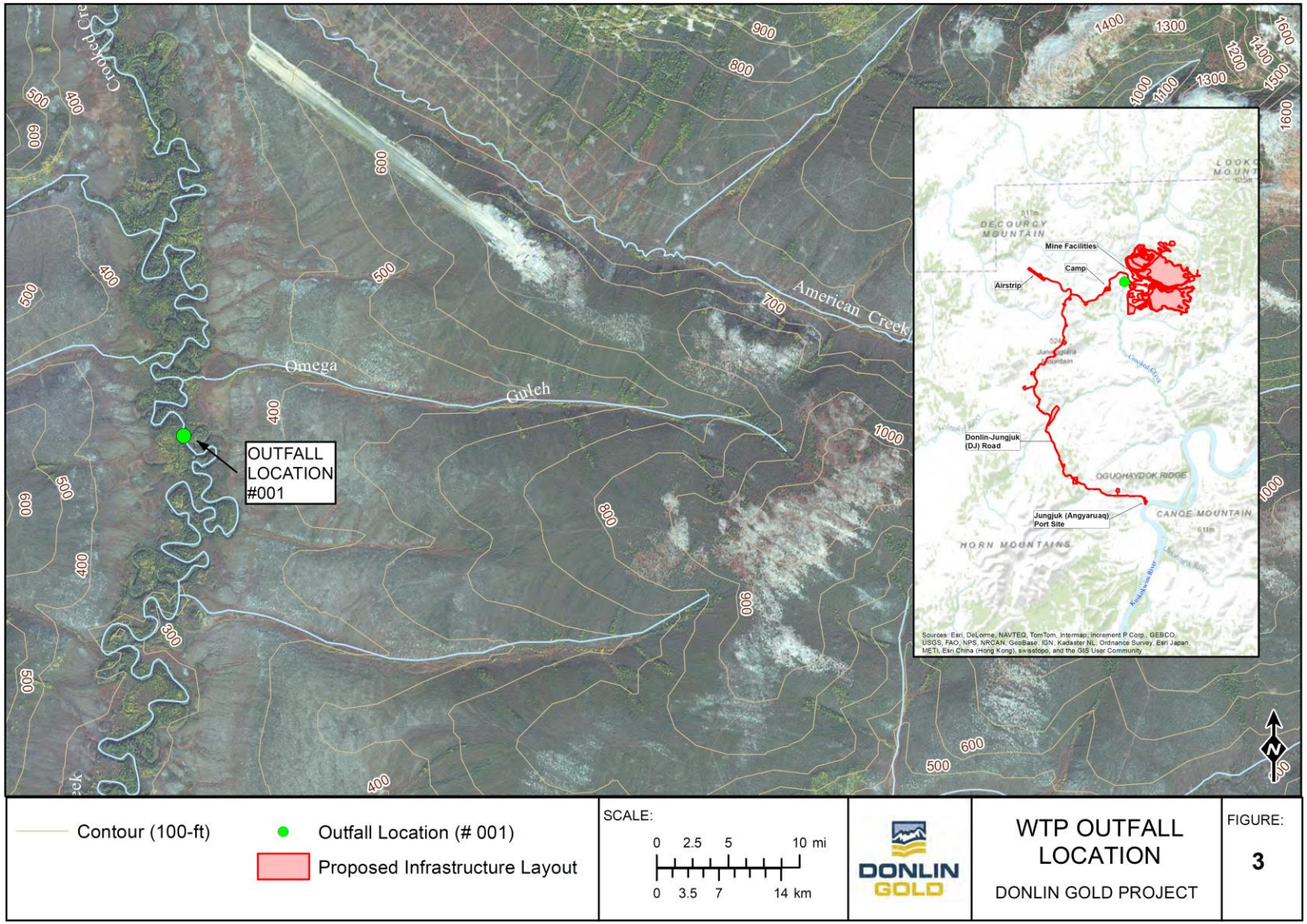
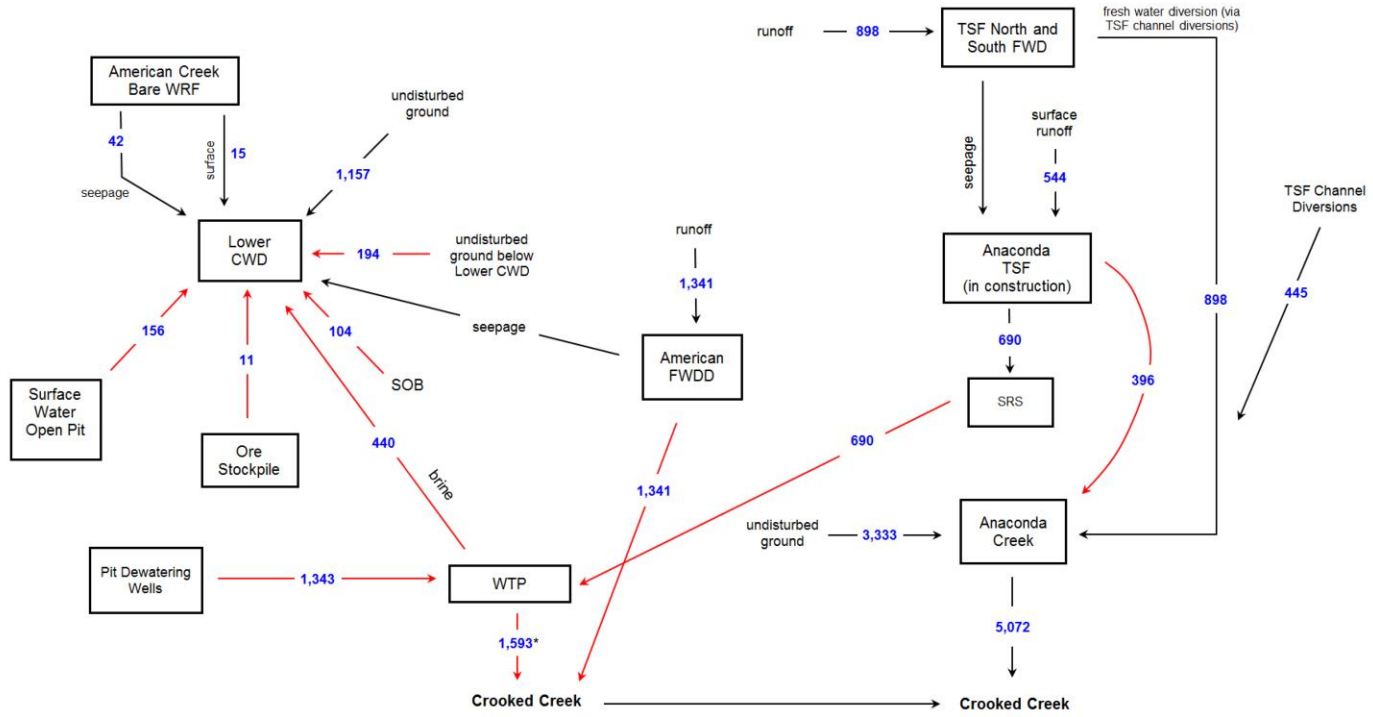


Figure 2: Line Drawing - Construction



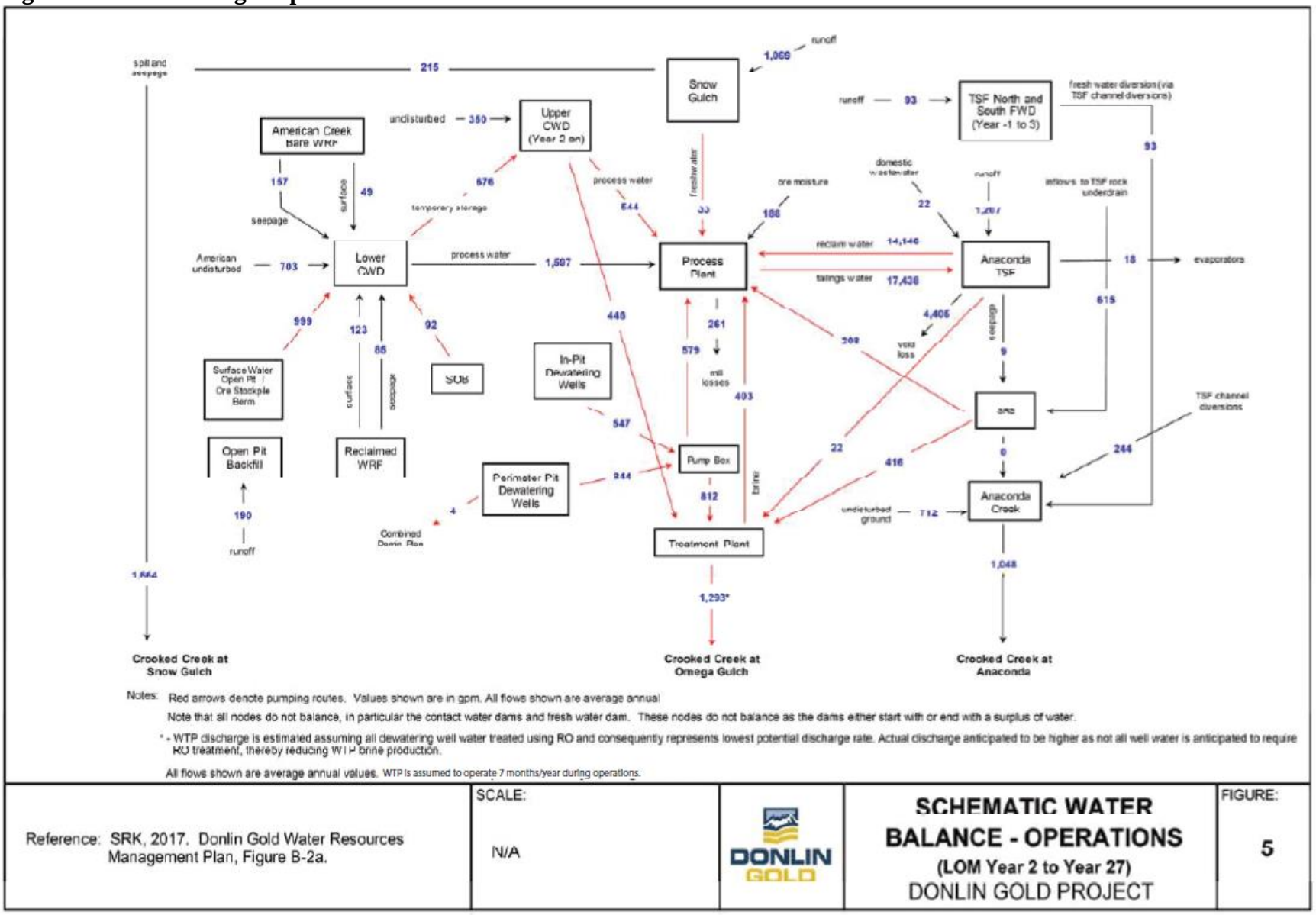
Note: Values shown are averaged over the simulation period and represent average precipitation conditions. Rates are in gpm.
Red arrows denote pumping routes.

* - WTP discharge is estimated assuming all dewatering well water treated using RO and consequently represents lowest potential discharge rate. Actual discharge anticipated to be higher as not all well water is anticipated to require RO treatment, thereby reducing WTP brine production.

All flows shown are average annual values. WTP is assumed to operate 12 months/year during construction.

Reference: SRK, 2017. Donlin Gold Water Resources Management Plan, Figure B-1a.	SCALE: N/A	DONLIN GOLD	**SCHEMATIC WATER BALANCE - CONSTRUCTION** (Q2 LOM Year -1 to end of Q2 LOM Year 1) DONLIN GOLD PROJECT	FIGURE: **4**

Figure 3: Line Drawing—Operations



Notes: Red arrows denote pumping routes. Values shown are in gpm. All flows shown are average annual

Note that all nodes do not balance, in particular the contact water dams and fresh water dam. These nodes do not balance as the dams either start with or end with a surplus of water.

* - WTP discharge is estimated assuming all dewatering well water treated using RO and consequently represents lowest potential discharge rate. Actual discharge anticipated to be higher as not all well water is anticipated to require RO treatment, thereby reducing WTP brine production.

All flows shown are average annual values. WTP is assumed to operate 7 months/year during operations.

Reference: SRK, 2017. Donlin Gold Water Resources Management Plan, Figure B-2a.	SCALE: N/A	DONLIN GOLD	**SCHEMATIC WATER BALANCE - OPERATIONS** (LOM Year 2 to Year 27) DONLIN GOLD PROJECT	FIGURE: 5

Figure 4: Water Management Features (Operations)

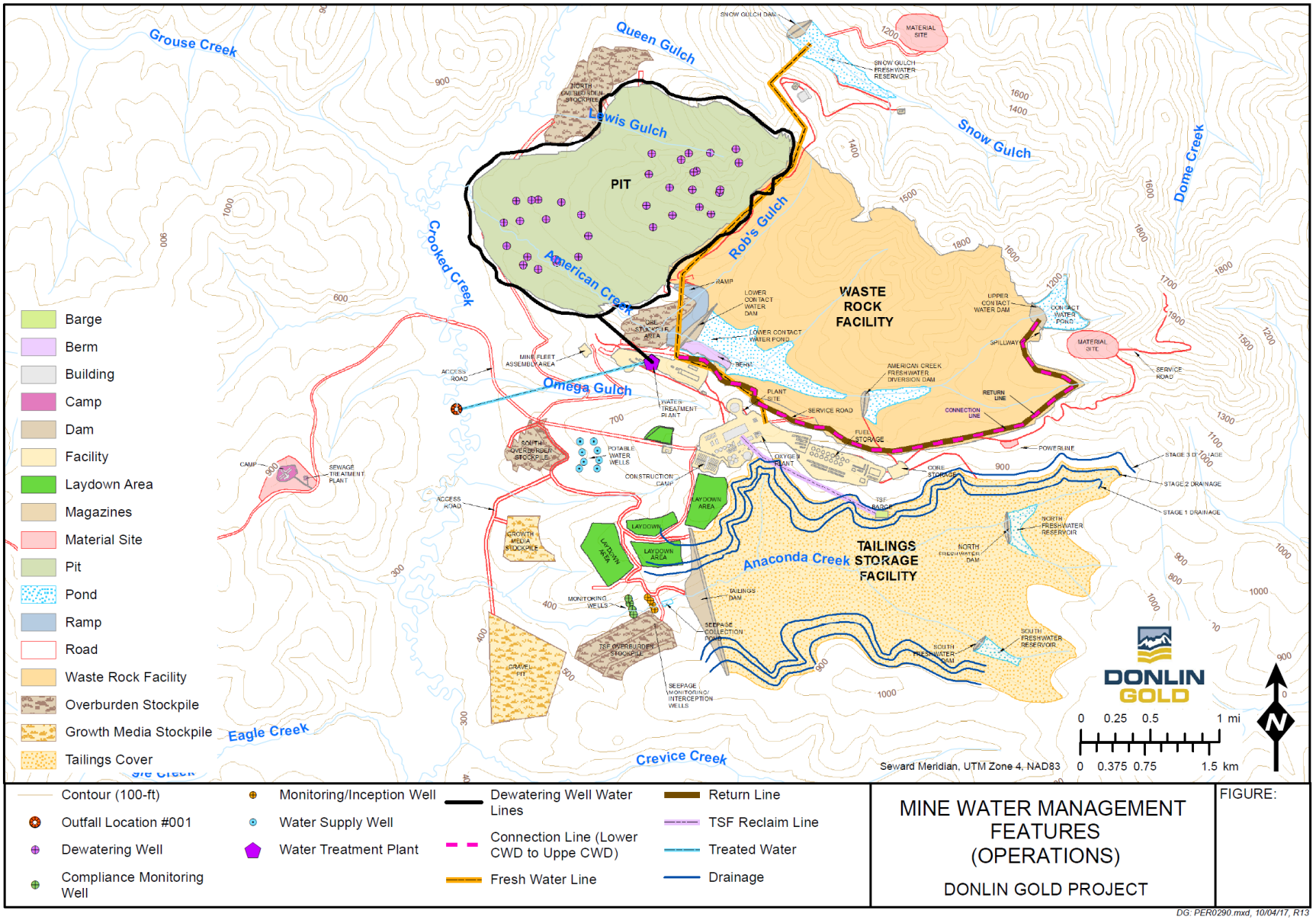
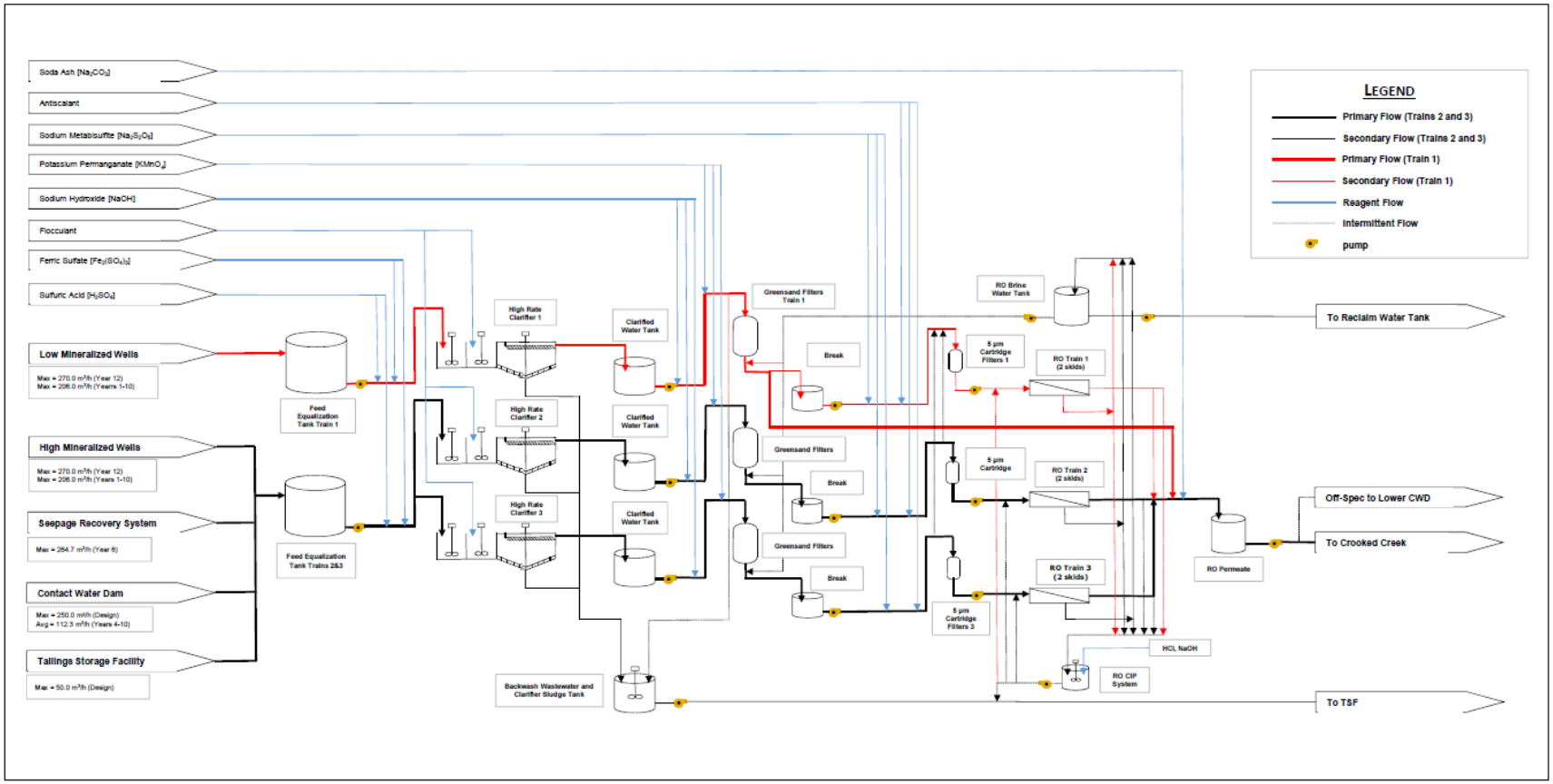
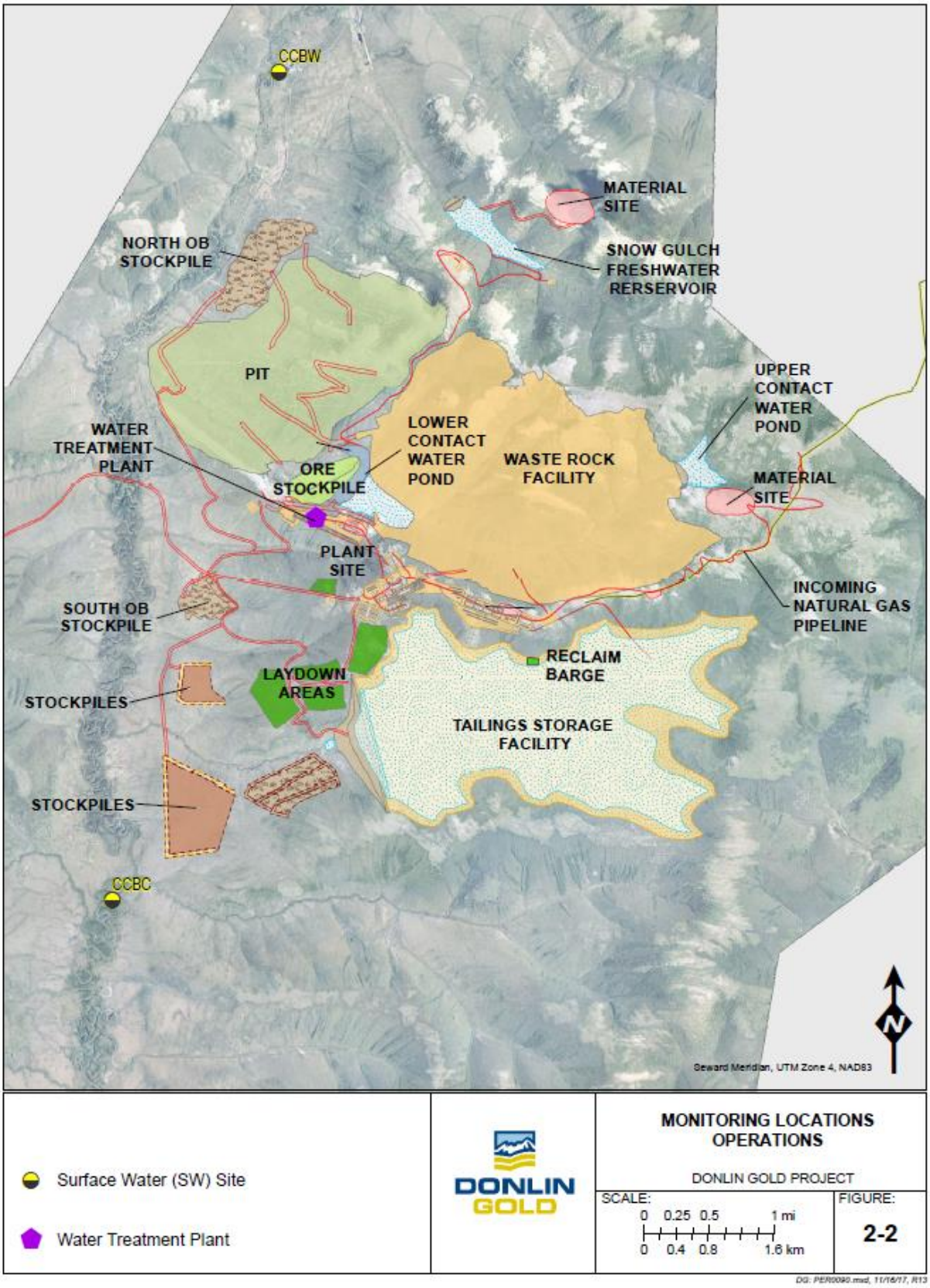


Figure 5: Water Treatment Schematic



	DONLIN GOLD	OPERATIONS WTP PROCESS FLOW DIAGRAM DONLIN GOLD PROJECT SCALE: / FIGURE: 7

Figure 6: Surface Water Monitoring Sites within Facilities Footprint



APPENDIX B. BASIS FOR EFFLUENT LIMITATIONS

The Clean Water Act (CWA) requires facilities to meet effluent limits based on available wastewater treatment technology, specifically, technology-based effluent limits (TBELs). TBELs are promulgated nationally by the Environmental Protection Agency (EPA) via Effluent Limitation Guideline (ELG) rulemakings and establish performance standards for all facilities within an industrial category or subcategory. The Alaska Department of Environmental Conservation (DEC or the Department) may find, by analyzing the effect of an effluent discharge on the receiving water body, that TBELs are not sufficiently stringent to meet State water quality standards (WQS). In such cases, the Department is required to develop more stringent water quality-based effluent limits (WQBEL), which are designed to ensure that the WQS of the receiving water body are met.

TBELs for facilities do not limit every parameter that may be present in the effluent. Depending on where the facility draws its water and how it handles its wastewater, the effluent may contain other pollutants not regulated by TBELs. When TBELs do not exist for a particular pollutant expected to be in the effluent, the Department must determine if the pollutant may cause or contribute to an exceedance of a WQS for the water body. If a pollutant causes or contributes to an exceedance of a WQS, a WQBEL for the pollutant must be established in the permit.

B-I Statutory and Regulatory Basis for Limits

CWA Sections 101, 301(b), 304, 308, 401, 402, and 405 of the Clean Water Act (CWA) provide the legal basis for the effluent limitations and other conditions in the permit. The Department evaluates the discharges with respect to these sections of the CWA and the relevant Alaska Pollutant Discharge Elimination System (APDES) regulations to determine which conditions to include in the permit.

In general, the Department first determines if any federally-promulgated TBELs have been developed that must be considered as minimum permit limits. The Department then evaluates the effluent quality expected to result from these controls to see if the discharge could result in any exceedances of the WQS in the receiving water. If reasonable potential exists that exceedances could or will occur, the Department must include WQBELs in the permit. The final selected permit limits reflect whichever requirements (technology-based or water quality-based) are more stringent.

B-II Outfall 001 - Technology-Based Evaluation

Section 301(b) of the CWA requires industrial dischargers to meet technology-based ELGs established by EPA. These are enforceable through their incorporation into an APDES permit. Direct dischargers that are new sources must meet New Source Performance Standards (NSPS), which are based on the best available demonstrated control technology. These NSPS apply to a source that has commenced construction after the ELGs were established and, as such, are directly applicable to the discharge of treated mine drainage and process water from Outfall 001 at the Donlin Gold Project.

In 40 CFR Part 440 Subpart J, EPA established ELGs for the Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores point source category. These ELGs apply NSPS to a new source mine, which is a source that has commenced construction after the ELGs were established on December 3, 1982. The NSPS that apply to the Donlin Gold Project are shown in Table B-1.

In 40 CFR Part 401.17, EPA established pH effluent limitations under continuous pH monitoring which was adopted by reference in 18 AAC 83.010(g) and exercised in Permit Part 1.2.4.

Table B-1: Technology-Based Effluent Limits for Outfall 001

Parameter	Units	Maximum Daily Limit	Average Monthly Limit	Range
Cadmium	mg/L[a]	0.10	0.05	-
Copper	mg/L	0.30	0.15	-
Lead	mg/L	0.6	0.3	-
Mercury	mg/L	0.002	0.001	-
Zinc	mg/L	1.5	0.75	-
pH	s.u.[b]	-	-	6.0-9.0
Total Suspended Solids (TSS)	mg/L	30.0	20.0	-

a. Milligrams per liter.
b. Standard units.

B-III Water Quality-Based Evaluation

In addition to the TBELs discussed above, the Department evaluated the discharge to determine compliance with Section 301(b)(1)(C) of the CWA. This section requires permit limits necessary to meet WQS.

Under 18 AAC 83.435, the Department must implement Section 301(b)(1)(C) of the CWA. It requires that APDES permits include limits for all pollutants or parameters which "are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state WQS, including state narrative criteria for water quality." The limits must be stringent enough to ensure that WQS are met and must be consistent with any available wasteload allocation (WLA).

To determine if WQBELs are needed and to develop those limits when necessary, the Department follows guidance in the *APDES Permits Reasonable Potential Analysis and Effluent Limits Development Guide* (RPA Guidance, 2014). The water quality-based analysis consists of the following three step sequence:

1. Identify the applicable water quality criteria (see Section B-III.A);
2. Determine if there is "reasonable potential" for the discharge to exceed a water quality criterion in the receiving water (see APPENDIX C);
3. If there is "reasonable potential" or where a parameter has a technology-based limit and it requires dilution to meet WQS, develop effluent limits based on the WLA (see Section APPENDIX D).

The following sections provide a detailed discussion of each step.

B-III.A Water Quality Criteria

The first step in determining if WQBELs are needed is to identify the applicable water quality criteria. Alaska's WQS are found at 18 AAC 70. The applicable criteria are determined based on the beneficial uses of the receiving water.

The beneficial uses for Crooked Creek, the receiving water of Outfall 001, and the regulatory citation for the water quality criteria applicable to the uses are as follows:

1. domestic water supply – 18 AAC 70.020(b)(1)(A)(i)
2. agriculture water supply – 18 AAC 70.020(b)(1)(A)(ii)
3. aquaculture water supply – 18 AAC 70.020(b)(1)(A)(iii)
4. industrial uses – 18 AAC 70.020(b)(1)(A)(iv)
5. contact recreation – 18 AAC 70.020(b)(1)(B)(i)
6. secondary recreation – 18 AAC 70.020(b)(1)(B)(ii)
7. growth and propagation of fish, shellfish, other aquatic life, and wildlife – 18 AAC 70.020(b)(1)(C)

For a given pollutant, different uses may have different criteria. To protect all beneficial uses, the reasonable potential analysis and permit limits are based on the most stringent water quality criteria for protecting those uses. For Crooked Creek, the most stringent applicable criteria are summarized in Table B-2.

Table B-2: Most Stringent of the Water Quality Criteria Applicable to Crooked Creek at Outfall 001

Parameter[a] (µg/L unless otherwise noted)	Aquatic Life Criterion		Human Health Criterion [c]
	Acute	Chronic	
Aluminum	750	87	N/A
Ammonia as N (mg/L) [d]	6.9	2.8	N/A
Antimony	N/A	N/A	6.0
Arsenic	340	148	10
Barium	N/A	N/A	2,000
Beryllium	N/A	N/A	4.0
Boron	N/A	N/A	750
Cadmium [b]	1.84	0.24	5.0
Chloride	860,000	230,000	250,000
Chromium, Total	N/A	N/A	100
Cobalt	N/A	N/A	50
Copper [b]	12.2	8.2	200
Cyanide (as WAD CN)	22	5.2	200
Fluoride	N/A	N/A	1,000

Parameter[a] (µg/L unless otherwise noted)	Aquatic Life Criterion		Human Health Criterion [c]
	Acute	Chronic	
Iron	N/A	1,000	5,000
Lead [b]	68	2.6	50
Lithium	N/A	N/A	2,500
Manganese	N/A	N/A	50
Mercury	2.4	0.01	0.05
Molybdenum	N/A	N/A	10
Nickel [b]	414	46	200
Nitrate as N	N/A	N/A	10,000
Selenium	20	5	10
Silver [b]	2.9	N/A	N/A
Thallium	N/A	N/A	1.7
Vanadium	N/A	N/A	100
Zinc [b]	106	106	2,000
Sulfate (mg/L)	N/A	N/A	250
Total Dissolved Solids (TDS, mg/L)	N/A	N/A	500

a. Criteria for metals have been converted to total recoverable.
b. Hardness-based limits using a hardness of 86 mg/L $CaCO_3$, the 15^{th} percentile of background data.
c. Most stringent of all uses not including aquatic life criterion.
d. Ammonia criteria based on a temperature of 6.4ºC and pH of 7.9 standard units.

APPENDIX C. REASONABLE POTENTIAL DETERMINATION

The following describes the process the Department used to determine if the discharge authorized in the draft permit has the reasonable potential (RP) to cause or contribute to a violation of WQS. The Department used the process described in the *Technical Support Document for Water Quality-Based Toxics Control* (EPA, 1991) and DEC's guidance, *Alaska Pollutant Discharge Elimination System (APDES) Permits Reasonable Potential Analysis and Effluent Limits Development Guide* (June 30, 2014) to determine RP for any pollutant to exceed a water quality criterion (WQC).

To determine if there is reasonable potential for the discharge to cause or contribute to an exceedance of WQC for a given pollutant, the Department compares the maximum projected receiving water body concentration to the criteria for that pollutant. RP to exceed exists if the projected receiving water body concentration exceeds the criteria, and a WQBEL must be included in the permit (18 AAC 83.435).

The ambient concentration in the mass balance equation is based on a reasonable worst-case estimate of the pollutant concentration upstream from the discharge. For criteria that are expressed as maxima, the 85th percentile of the ambient data is generally used as an estimate of the worst-case. If ambient data are not available, DEC uses 15% of the most stringent pollutant's criteria as a worst-case estimate. This section discusses how the maximum projected receiving waterbody concentration is determined.

Outfall 001

For Outfall 001, the maximum expected effluent concentrations were compared directly to the most stringent water quality criteria. Note, the estimated maximum effluent concentrations were used in the analysis. MECs were calculated using the highest estimated effluent concentration and the application of a conservative coefficient of variability and corresponding reasonable potential multiplier that resulted in reasonable potential determinations for the discharge to exceed WQS for the parameters of concern.

C_e (Maximum expected effluent concentration or MEC): The maximum expected effluent concentration was calculated using the statistical approach recommended in Section 2.4 of the *RPA Guidance*. In this approach, a maximum expected effluent concentration is derived by multiplying the maximum expected effluent concentration by a reasonable potential multiplier (RPM):

C_e = MEC = (maximum expected effluent concentration) x RPM

The RPM accounts for uncertainty in the effluent data. The RPM depends upon the amount of effluent data, the statistical distribution assigned to the data, and the variability of the data as measured by the coefficient of variation (CV). Effluent data for each pollutant of concern was analyzed in ProUCL—a statistical software package developed under the direction of EPA—and the statistical distributions and corresponding CVs that best fit the data were selected. As actual effluent data do not exist for the Donlin Gold site, the default CV value of 0.6 was applied for the analysis.

There are three equations in the *RPA Guidance* for calculating the RPM. Each equation is valid for certain statistical distributions or sample populations. These three equations—with the citation to the Section in the *RPA Guidance* in which they appear are:

Equation 2.4.1.1 (RPM for Small or Insufficient Data Sets)

$$\text{RPM} = \frac{\exp(z_{99}\hat{\sigma} - 0.5\hat{\sigma}^2)}{\exp(p_n\hat{\sigma} - 0.5\hat{\sigma}^2)}$$

Where,

$z_{99} =$ the z-statistic at the 99th percentile = 2.326

$\hat{\sigma} =$ $[\ln(CV^2 + 1)]^{1/2}$

$\hat{\sigma}^2 =$ $\ln(CV^2 + 1)$

$CV =$ coefficient of variation (generally assumed to be 0.6 for small data sets)

$p_n =$ the z-statistic at the 95 percent confidence level = $(1\text{-}0.95)^{(1/n)}$

$n =$ the number of valid samples

Equation 2.4.2.1 (RPM for Non-Parametric, Normal, or Gamma Statistical Distributions)

$$RPM = \frac{\exp(\hat{\mu}_n + z_{99}\hat{\sigma})}{\exp(\hat{\mu}_n + p_n\hat{\sigma})}$$

Where,

$\hat{\mu}_n =$ the mean calculated by ProUCL

$\hat{\sigma} =$ the standard deviation calculated by ProUCL

Equation 2.4.2.2 (RPM for Lognormal or Log-ROS Statistical Distributions)

$$RPM = \frac{\exp(z_{99}\hat{\sigma}_y - 0.5\hat{\sigma}_y{}^2)}{\exp(p_n\hat{\sigma}_y - 0.5\hat{\sigma}_y{}^2)}$$

Where,

$\hat{\sigma}_y =$ the lognormal standard deviation calculated by ProUCL

$\hat{\sigma}_y{}^2 =$ the lognormal variance (square of the standard deviation calculated by ProUCL)

Table C-1 shows the assigned statistical distribution, references the equation used to calculate the RPM, and lists the calculated RPM for each parameter at Outfall 001.

Table C-1: RPM Calculation for Outfall 001

Parameter	Statistical Distribution	Equation	RPM
Aluminum	Not Applicable	2.4.1.1	9.0
Ammonia as N	Not Applicable	2.4.1.1	9.0
Antimony	Not Applicable	2.4.1.1	9.0
Arsenic	Not Applicable	2.4.1.1	9.0
Barium	Not Applicable	2.4.1.1	9.0
Beryllium	Not Applicable	2.4.1.1	9.0
Boron	Not Applicable	2.4.1.1	9.0
Cadmium	Not Applicable	2.4.1.1	9.0
Chloride	Not Applicable	2.4.1.1	9.0
Chromium, Total	Not Applicable	2.4.1.1	9.0
Cobalt	Not Applicable	2.4.1.1	9.0
Copper	Not Applicable	2.4.1.1	9.0
Cyanide (as WAD CN)	Not Applicable	2.4.1.1	9.0
Fluoride	Not Applicable	2.4.1.1	9.0
Iron	Not Applicable	2.4.1.1	9.0
Lead	Not Applicable	2.4.1.1	9.0
Lithium	Not Applicable	2.4.1.1	9.0
Manganese	Not Applicable	2.4.1.1	9.0
Mercury	Not Applicable	2.4.1.1	9.0
Molybdenum	Not Applicable	2.4.1.1	9.0
Nickel	Not Applicable	2.4.1.1	9.0
Nitrate as N	Not Applicable	2.4.1.1	9.0
Selenium	Not Applicable	2.4.1.1	9.0
Silver	Not Applicable	2.4.1.1	9.0
Thallium	Not Applicable	2.4.1.1	9.0
Vanadium	Not Applicable	2.4.1.1	9.0
Zinc	Not Applicable	2.4.1.1	9.0
Sulfate	Not Applicable	2.4.1.1	9.0
TDS	Not Applicable	2.4.1.1	9.0

Reasonable Potential Summary: Results of the reasonable potential analysis for Outfall 001 are provided in Table C-2.

Table C-2: Reasonable Potential Determination for Outfall 001

Parameter[a] (µg/L unless otherwise noted)	Effluent Data					Most Stringent Water Quality Criterion	Reasonable Potential (yes or no)
	Max Observed Effluent Conc. [e]	Coefficient of Variation (CV)	Number of Samples	Reasonable Potential Multiplier (RPM)	Max Expected Effluent Conc. (MEC)[b]		
Aluminum	50	0.6	1	9.0	452.10	Chronic Aquatic Life	Yes
Ammonia as N (mg/L)	0.5	0.6	1	9.0	4.52	Chronic Aquatic Life	Yes
Antimony	5.0	0.6	1	9.0	45.21	DW [d]	Yes
Arsenic	6.0	0.6	1	9.0	54.25	DW	Yes
Barium	400	0.6	1	9.0	3,616.84	DW	Yes
Beryllium	0.59	0.6	1	9.0	5.33	DW	Yes
Boron	25.0	0.6	1	9.0	452.1	Irrigation	No
Cadmium	0.11	0.6	1	9.0	0.99	Chronic Aquatic Life	Yes
Chloride	1,000	0.6	1	9.0	9,042.09	Chronic Aquatic Life	No
Chromium, Total	2.0	0.6	1	9.0	18.08	DW	No
Cobalt	2.0	0.6	1	9.0	9.04	Irrigation	No
Copper	1.0	0.6	1	9.0	9.04	Chronic Aquatic Life	Yes
Cyanide (as WAD CN)	1.0	0.6	1	9.0	45.21	Chronic Aquatic Life	Yes
Fluoride	400	0.6	1	9.0	3,616.84	Irrigation	Yes
Iron	50	0.6	1	9.0	452.10	Chronic Aquatic Life	No

Parameter[a] (µg/L unless otherwise noted)	Effluent Data					Most Stringent Water Quality Criterion	Reasonable Potential (yes or no)
	Max Observed Effluent Conc. [e]	Coefficient of Variation (CV)	Number of Samples	Reasonable Potential Multiplier (RPM)	Max Expected Effluent Conc. (MEC)[b]		
Lead	1.0	0.6	1	9.0	9.04	Chronic Aquatic Life	Yes
Lithium	170	0.6	1	9.0	1,537.15	Irrigation	No
Manganese	50	0.6	1	9.0	452.10	Water + Aquatic	Yes
Mercury	0.01	0.6	1	9.0	0.11	Chronic Aquatic Life	Yes
Molybdenum	5.0	0.6	1	9.0	45.21	Irrigation	Yes
Nickel	5.0	0.6	1	9.0	45.21	Chronic Aquatic Life	No
Nitrate as N	7,800	0.6	1	9.0	70,528.28	DW	Yes
Selenium	5.0	0.6	1	9.0	45.21	Chronic Aquatic Life	Yes
Silver	1.4	0.6	1	9.0	12.66	Acute Aquatic Life	Yes
Thallium	0.82	0.6	1	9.0	7.41	Water + Aquatic Organisms	Yes
Vanadium	8.4	0.6	1	9.0	75.95	Irrigation	No
Zinc	20	0.6	1	9.0	180.84	Acute & Chronic Aquatic Life	Yes
Sulfate (mg/L)	60	0.6	1	9.0	542.53	DW	Yes
TDS (mg/L)	240	0.6	1	9.0	2,170.10	DW	Yes

a. Criteria for metals have been converted to total recoverable.

Parameter[a] (µg/L unless otherwise noted)	Effluent Data					Most Stringent Water Quality Criterion	Reasonable Potential (yes or no)
	Max Observed Effluent Conc. [e]	Coefficient of Variation (CV)	Number of Samples	Reasonable Potential Multiplier (RPM)	Max Expected Effluent Conc. (MEC)[b]		

b. For each parameter, the MEC equals the maximum observed effluent concentration times the RPM producing a number based on water treatment plant performance, which was used to determine if there is a reasonable potential for the effluent to exceed WQS.
c. Hardness-based limits using a hardness of 86 mg/L $CaCO_3$, the 15^{th} percentile of background data.
d. Drinking Water
e. Maximum observed concentration was calculated from estimated effluent quality based on predicted influent water quality based on groundwater quality data and estimated water treatment facility removal efficiencies for each parameter of concern.

APPENDIX D. EFFLUENT LIMIT CALCULATION

Once the Alaska Department of Environmental Conservation (the Department or DEC) determines that the effluent has a reasonable potential to exceed State Water Quality Standards (WQS) or a parameter has a technology-based effluent limit (TBEL) that exceeds WQS, a water quality-based effluent limit (WQBEL) for the pollutant is developed. Outfall 001 was shown to have reasonable potential to exceed WQS so WQBELs were developed.

The first step in calculating a permit limit is development of a wasteload allocation (WLA) for the pollutant. The WLA is the concentration of the pollutant that may be discharged while still ensuring that the downstream water quality criterion is met.

Outfall 001

The derivation of WQBELs for Outfall 001 is described below.

End-of-Pipe WLAs

In the absence of dilution, the applicable water quality criterion becomes the WLA. Establishing the criterion as the WLA ensures that the Permittee's discharge does not contribute to an exceedance of the criterion. There may be up to three different WLAs for a given pollutant if there are acute, chronic, and human health water quality criteria for the pollutant. These WLAs include the acute WLA (WLA_{acute}), chronic WLA ($WLA_{chronic}$), and the human health WLA (WLA_{hheath}).

Long Term Averages (LTAs)

Acute, chronic, and human health standards apply over different time frames; therefore, it is not possible to compare the WLAs directly to determine which standard results in the most stringent limits. The acute criteria are applied as a one-hour average, the chronic criteria are applied as a four-day average, and human health criteria generally apply over a lifetime of exposure. To allow for comparison, long term average (LTA) loads are calculated from the acute and chronic WLAs. The most stringent LTA is used to calculate the permit limits.

Permit Limit Derivation

Once the appropriate LTA has been calculated, the Department applies the statistical approach described in Chapter 3 of the *RPA Guidance* to calculate maximum daily and average monthly permit limits. This approach takes into account effluent variability [using the Coefficient of Variation (CV)], sampling frequency, and the difference in time frames between the average monthly and maximum daily limits.

The maximum daily limit is based on the CV of the data and the probability basis, while the average monthly limit is dependent on these two variables and the monitoring frequency. As recommended in the *RPA Guidance*, the Department used a probability basis of 95 percent for average monthly limit calculation and 99 percent for the maximum daily limit calculation.

The following is a summary of the steps to derive WQBELs. Copper is used as an example.

Step 1- Determine the WLA

In this case, where there is no dilution, the acute, chronic, and human health criteria become the WLAs. As shown in Table B-2, the acute, chronic, and human health water quality criteria for copper are 12.2, 8.2, and 200 µg/L, respectively. Accordingly, the respective WLAs are:

$WLA_{acute} = 12.2$ µg/L

$WLA_{chronic} = 8.2$ µg/L

$WLA_{hhealth} = 200$ µg/L

Step 2 - Determine the Long-Term Average (LTA)

From Section 3.3 in the *RPA Guidance*,

$$LTA_{acute} = WLA_{acute} * e^{(0.5\sigma^2 - z_{99}\sigma)}$$

Where,

$\sigma^2 = \ln(CV^2 + 1)$

$\sigma^2 = \ln(0.6^2 + 1)$

$\sigma^2 = 0.3075$

$\boldsymbol{LTA_{acute} = 3.9\ \mu g/L}$

$$LTA_{chronic} = WLA_{chronic} * e^{(0.5{\sigma_4}^2 - z_{99}\sigma_4)}$$

Where,

$${\sigma_4}^2 = \ln\left(\frac{CV^2}{4} + 1\right)$$

$${\sigma_4}^2 = \ln\left(\frac{0.6^2}{4} + 1\right)$$

${\sigma_4}^2 = 0.0862$

$\boldsymbol{LTA_{chronic} = 4.3\ \mu g/L}$

Step 3 - Most Limiting LTA

To protect a waterbody from both acute and chronic effects, the most limiting of the calculated LTAs is used to derive the effluent limitations. LTA_{acute} is the most limiting LTA.

Step 4 - Calculate the Permit Limits

The *RPA Guidance* recommends using the 95th percentile for the Average Monthly Limit (AML) and the 99th percentile for the Maximum Daily Limit (MDL). The MDL and the AML for aquatic life are calculated as follows:

$$\text{MDL}_{aquatic} = LTA_{acute} * e^{(z_{99}\sigma - 0.5\sigma^2)}$$

Where,

$\sigma^2 = 0.3075$ (as previously calculated)

$\boldsymbol{MDL_{aquatic} = 12.19\ \mu g/L}$

$\text{AML}_{aquatic} = LTA_{acute} * e^{(z_{95}\sigma_n - 0.5{\sigma_n}^2)}$

Where,

$${\sigma_n}^2 = \ln\left(\frac{CV^2}{n} + 1\right)$$

$${\sigma_n}^2 = \ln\left(\frac{0.6^2}{4} + 1\right)$$

${\sigma_n}^2 = 0.0862$

n = number of sampling events per month for copper = 4

$\boldsymbol{AML_{aquatic} = 6.08\ \mu g/L}$

The procedure for developing effluent limits for human health effects is different than for acute and chronic effects to aquatic life. The Department uses the procedure in Section 3.4.2 of the *RPA Guidance*. For copper,

$\text{AML}_{hhealth} = WLA_{hhealth} = \mathbf{200\ \mu g/L}$

$$\text{MDL}_{hhealth} = AML_{hhealth} \cdot \frac{e^{(z_{99}\sigma - 0.5\sigma^2)}}{e^{(z_{95}\sigma_n - 0.5{\sigma_n}^2)}}$$

Where,

$\sigma^2 = 0.3075$ (as previously calculated)

${\sigma_n}^2 = 0.0862$ (as previously calculated)

$\boldsymbol{\text{MDL}_{hhealth} = 401.24\ \mu g/L}$

In this case, the MDL and AML for human health are less protective than the corresponding limits for acute and chronic effects to aquatic life. Consequently, the human health based limits were rejected in favor of the more stringent limits based on acute and chronic effects.

Table D-1 summarizes the WQBEL calculations for Outfall 001.

Table D-1: Water Quality-Based Effluent Limit Calculations for Outfall 001

Parameter (µg/L unless otherwise noted)	**Most Stringent Water Quality Criterion**	**CV**	**WLA_{acute}**	**$WLA_{chronic}$**	**$WLA_{hhealth}$**	**$LTA_{limiting}$**	**MDL**	**AML**
Aluminum	87	0.6	750.00	87.00	N/A	45.89	140	71
Ammonia as N (mg/L)	2.8	0.6	6.89	2.84	N/A	2.21	6.9	2.6
Antimony	6.0	0.6	N/A	N/A	6.00	N/A	12	6.0
Arsenic	10	0.6	339.80	147.90	10.00	78.01	20	10
Barium	2,000	0.6	N/A	N/A	2,000.00	N/A	4000	2000
Beryllium	4.0	0.6	N/A	N/A	4.00	N/A	8.0	4.0
Cadmium	0.24	0.6	1.84	0.24	5.00	0.13	0.4	0.2
Copper	8.2	0.6	12.19	8.23	200.00	3.91	12	6.1
Cyanide (as WAD CN)	5.2	0.6	22.00	5.20	200.00	2.74	8.5	4.3
Fluoride	1,000	0.6	N/A	N/A	1,000.00	N/A	2000	1000
Lead	2.6	0.6	67.73	2.64	50.00	1.39	4.3	2.2
Manganese	50	0.6	N/A	N/A	50.00	N/A	100	50
Mercury	0.01	0.6	2.40	0.01	0.05	0.01	0.020	0.0098
Molybdenum	10	0.6	N/A	N/A	10.00	N/A	20	10
Nitrate as N	10,000	0.6	N/A	N/A	10,000.00	N/A	20,000	10,000
Selenium	5.0	0.6	20.00	5.00	10.00	2.64	8.2	4.1
Silver	2.9	0.6	2.94	N/A	N/A	0.94	2.9	1.5
Thallium	1.7	0.6	N/A	N/A	1.70	N/A	3.4	1.7
Zinc	106	0.6	105.81	105.81	2,000.00	33.97	110	53
Sulfate (mg/L)	250	0.6	N/A	N/A	250.00	N/A	500	250
TDS (mg/L)	500	0.6	N/A	N/A	500.00	N/A	1000	500